

IN THE UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF DELAWARE

|                                  |   |                               |
|----------------------------------|---|-------------------------------|
| LG.PHILIPS LCD CO., LTD.,        | ) |                               |
|                                  | ) |                               |
| Plaintiff,                       | ) |                               |
|                                  | ) |                               |
| v.                               | ) | Civil Action No. 04-343 (JJF) |
|                                  | ) |                               |
| TATUNG COMPANY                   | ) |                               |
| TATUNG COMPANY OF AMERICA, INC.; | ) |                               |
| AND VIEWSONIC CORPORATION,       | ) |                               |
|                                  | ) |                               |
| Defendants.                      | ) |                               |

**NOTICE OF SERVICE OF DEPOSITION**

PLEASE TAKE NOTICE that copies of defendant Tatung Company's and Tatung Company of America, Inc. Notice of Deposition of NEC Electronics America, Inc. Pursuant to Rule 30(b)(6), a copy of which is attached hereto were served on February 22, 2007 upon the following counsel of record via electronic mail and Federal Express at the addresses indicated below:

Richard D. Kirk, Esquire  
The Bayard Firm  
222 Delaware Avenue #900  
Wilmington, DE 19899

Jeffrey B. Bove, Esquire  
Jaclyn M. Mason, Esquire  
Connolly Bove Lodge & Hutz LLP  
1007 North Orange Street  
P.O. Box 2207  
Wilmington, DE 19899

Gaspare J. Bono, Esquire  
Rel S. Ambrozy, Esquire  
Lora A. Brzezynski, Esquire  
Cass W. Christenson, Esquire  
McKenna Long & Aldridge LLP  
1900 K Street, N.W.  
Washington D.C. 20006

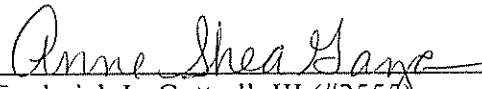
Tracy R. Roman, Esquire  
Raskin Peter Rubin & Simon LLP  
1801 Century Park East  
Suite 2300  
Los Angeles, CA 90067

Scott R. Miller, Esquire  
Connolly Bove Lodge & Hutz LLP  
355 South Grand Avenue  
Suite 3150  
Los Angeles, CA 90071

Of Counsel:  
Christopher Darrow  
Mark H. Krietzman  
Frank E. Merideth, Jr.  
Alan R. Maler  
Greenberg Traurig LLP  
2450 Colorado Avenue, Suite 400E  
Santa Monica, CA 90404  
Telephone: 310-586-7700

Kathryn L. Clune  
Greenberg Traurig LLP  
800 Connecticut Avenue, N.W., Suite 500  
Washington, DC 20006

Dated: February 23, 2007

  
Frederick L. Cottrell, III (#2555)  
Anne Shea Gaza (#4093)  
Richards, Layton & Finger, P.A.  
One Rodney Square  
P.O. Box 551  
Wilmington, Delaware 19899  
(302) 651-7700  
cottrell@rlf.com  
gaza@rlf.com  
*Attorneys for Defendants Tatung Company  
and Tatung Company of America Inc*

**UNITED STATES DISTRICT COURT  
DISTRICT OF DELAWARE**

**CERTIFICATE OF SERVICE**

I hereby certify that on February 23, 2007 I caused to be served by hand delivery the foregoing document and electronically filed the same with the Clerk of Court using CM/ECF which will send notification of such filing(s) to the following:

Richard D. Kirk, Esquire  
The Bayard Firm  
222 Delaware Avenue #900  
Wilmington, DE 19899

Jeffrey B. Bove, Esquire  
James Heisman, Esquire  
Jaclyn M. Mason, Esquire  
Connolly Bove Lodge & Hutz LLP  
1007 North Orange Street  
P.O. Box 2207  
Wilmington, DE 19899

I hereby certify that on February 23, 2007 I caused to be sent the foregoing document to the following non-registered participants in the manner indicated below:

**VIA FEDERAL EXPRESS**

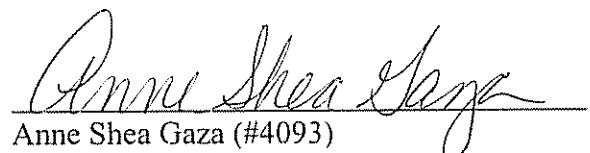
Gaspare J. Bono, Esquire  
Rel S. Ambrozy, Esquire  
Lora A. Brzezynski, Esquire  
Cass W. Christenson, Esquire  
McKenna Long & Aldridge LLP  
1900 K Street, N.W.  
Washington D.C. 20006

**VIA FEDERAL EXPRESS**

Tracy R. Roman, Esquire  
Raskin Peter Rubin & Simon LLP  
1801 Century Park East, Suite 2300  
Los Angeles, CA 90067

**VIA FEDERAL EXPRESS**

Scott R. Miller, Esquire  
Connolly Bove Lodge & Hutz LLP  
355 South Grand Avenue  
Suite 3150  
Los Angeles, CA 90071

  
Anne Shea Gaza (#4093)  
Gaza@rlf.com

IN THE UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF DELAWARE

LG PHILIPS LCD CO., LTD.,

Plaintiff,

v.

TATUNG CO.;  
TATUNG COMPANY OF AMERICA, INC.; AND  
VIEWSONIC CORPORATION

Defendants.

CIVIL ACTION NO. 04-343

**NOTICE OF DEPOSITION OF NEC ELECTRONICS AMERICA, INC.**  
**PURSUANT TO RULE 30(b)(6)**

TO ALL PARTIES AND THEIR ATTORNEYS OF RECORD:

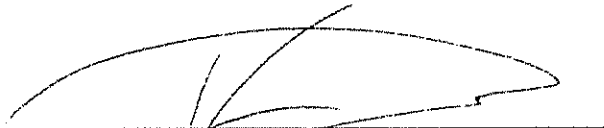
PLEASE TAKE NOTICE that pursuant to Rule 26 and Rule 30(b)(6) of the Federal Rules of Civil Procedure ("FRCP"), Defendants Tatung Company and Tatung Company of America will take the deposition of NEC Electronics America, Inc. ("NEC") beginning on March 15, 2007 at 10:00 a.m. at the offices of Greenberg Traurig, LLP located at 1900 University Avenue, 5<sup>th</sup> Floor, East Palo Alto, CA 94303, or at such other time and/or place as counsel for all parties may agree in writing. The deposition will be conducted upon oral examination before a certified court reporter authorized by law to administer oaths. The deposition will continue from day to day until completed. The deposition will be recorded by videotape and stenographically, and may use technology that permits the real time display of the deposition transcript. Parties wishing to see the real time display must supply their own computer.

Pursuant to FRCP 30(b)(6), NEC shall designate one or more officers, directors, agents or other representatives who consent to testify on its behalf, to testify as to matters known or

reasonably available to NEC regarding the topics listed in the attached list of topics. To the extent more than one deponent is identified, NEC shall state in advance of the deposition which portions of this notice each deponent is prepared to address.

All parties are invited to attend and cross-examine.

Of Counsel:  
Frederick L. Cottrell, III (#2555)  
Anne Shea Gaza (#4093)  
Richards, Layton & Finger, P.A.  
One Rodney Square  
P.O. Box 551  
Wilmington, Delaware 19899  
(302) 651-7700  
cottrell@rlf.com  
gaza@rlf.com



Frank E. Merideth, Jr.  
Mark H. Krietzman  
Valerie W. Ho  
Steve Hassid  
Greenberg Traurig LLP  
2450 Colorado Avenue, Suite 400E  
Santa Monica, CA 90404  
Telephone: 310-586-7700

*Attorneys for Defendant Tatung Company*

Dated: February 22, 2007

DAO 88 (Rev. 12/06) Subpoena in a Civil Case

Issued by the  
**UNITED STATES DISTRICT COURT**  
 CENTRAL DISTRICT OF CALIFORNIA

LG PHILIPS LCD CO, LTD

V.

TATUNG CO ;TATUNG COMPANY OF AMERICA,  
INC.; and VIEWSONIC CORPORATION**SUBPOENA IN A CIVIL CASE**Case Number: <sup>1</sup> 03-343  
USDC, District of DelawareTO: NEC ELECTRONICS AMERICA, INC  
c/o CT CORPORATION SYSTEM  
818 WEST SEVENTH ST.  
LOS ANGELES, CA 90017

- ☐ YOU ARE COMMANDED to appear in the United States District court at the place, date, and time specified below to testify in the above case

|                    |               |
|--------------------|---------------|
| PLACE OF TESTIMONY | COURTROOM     |
|                    | DATE AND TIME |

- ☒ YOU ARE COMMANDED to appear at the place, date, and time specified below to testify at the taking of a deposition in the above case.

|  |  |
|--|--|
| PLACE OF DEPOSITION Greenberg Traurig LLP<br>1900 University Avenue, 5th Floor, East Palo Alto, CA 94303 | DATE AND TIME<br>March 15, 2007 10:00 am |
|--|--|

- ☒ YOU ARE COMMANDED to produce and permit inspection and copying of the following documents or objects at the place, date, and time specified below (list documents or objects):


See Attachment A

|  |  |
|--|--|
| PLACE Greenberg Traurig LLP<br>1900 University Avenue, 5th Floor, East Palo Alto, CA 94303 | DATE AND TIME<br>March 12, 2007 10:00 am |
|--|--|

- ☐ YOU ARE COMMANDED to permit inspection of the following premises at the date and time specified below.

|          |               |
|----------|---------------|
| PREMISES | DATE AND TIME |
|----------|---------------|

Any organization not a party to this suit that is subpoenaed for the taking of a deposition shall designate one or more officers, directors, or managing agents, or other persons who consent to testify on its behalf, and may set forth, for each person designated, the matters on which the person will testify. Federal Rules of Civil Procedure, 30(b)(6)

|  |                           |
|--|---------------------------|
| ISSUING OFFICER'S SIGNATURE AND TITLE (INDICATE IF ATTORNEY FOR PLAINTIFF OR DEFENDANT)<br> Attorney for Defendants Tatung Co, and Tatung Co of America | DATE<br>February 22, 2007 |
|--|---------------------------|

ISSUING OFFICER'S NAME, ADDRESS AND PHONE NUMBER  
 VALERIE HO, ESQ., GREENBERG TRAURIG, LLP, 2450 Colorado Avenue, Suite 400E, Santa Monica, CA 90404 (310) 586-7700

(See Rule 45, Federal Rules of Civil Procedure, Subdivisions (c), (d), and (e), on next page)

<sup>1</sup> If action is pending in district other than district of issuance, state district under case number

AO 88 (Rev 12/06) Subpoena in a Civil Case

**PROOF OF SERVICE**

DATE

PLACE

SERVED:

SERVED ON (PRINT NAME)

MANNER OF SERVICE

SERVED BY (PRINT NAME)

TITLE

**DECLARATION OF SERVER**

I declare under penalty of perjury under the laws of the United States of America that the foregoing information contained in the Proof of Service is true and correct.

Executed on

DATE

SIGNATURE OF SERVER

ADDRESS OF SERVER

Rule 45, Federal Rules of Civil Procedure, Subdivisions (c), (d), and (e), as amended on December 1, 2006:

**(c) PROTECTION OF PERSONS SUBJECT TO SUBPOENAS**

(1) A party or an attorney responsible for the issuance and service of a subpoena shall take reasonable steps to avoid imposing undue burden or expense on a person subject to that subpoena. The court on behalf of which the subpoena was issued shall enforce this duty and impose upon the party or attorney in breach of this duty an appropriate sanction, which may include, but is not limited to, lost earnings and a reasonable attorney's fee.

(2) (A) A person commanded to produce and permit inspection, copying, testing, or sampling of designated electronically stored information, books, papers, documents or tangible things, or inspection of premises need not appear in person at the place of production or inspection unless commanded to appear for deposition, hearing or trial.

(B) Subject to paragraph (d)(2) of this rule, a person commanded to produce and permit inspection, copying, testing, or sampling may, within 14 days after service of the subpoena or before the time specified for compliance if such time is less than 14 days after service, serve upon the party or attorney designated in the subpoena written objection to producing any or all of the designated materials or inspection of the premises — or to producing electronically stored information in the form or forms requested. If objection is made, the party serving the subpoena shall not be entitled to inspect, copy, test, or sample the materials or inspect the premises except pursuant to an order of the court by which the subpoena was issued. If objection has been made, the party serving the subpoena may, upon notice to the person commanded to produce, move at any time for an order to compel the production, inspection, copying, testing, or sampling. Such an order to compel shall protect any person who is not a party or an officer of a party from significant expense resulting from the inspection, copying, testing, or sampling commanded.

(3) (A) On timely motion the court by which a subpoena was issued shall quash or modify the subpoena if it

(i) fails to allow reasonable time for compliance;

(ii) requires a person who is not a party or an officer of a party to travel to a place more than 100 miles from the place where that person resides, is employed or regularly transacts business in person, except that, subject to the provisions of clause (c)(3)(B)(iii) of this rule, such a person may in order to attend trial be commanded to travel from any such place within the state in which the trial is held;

(iii) requires disclosure of privileged or other protected matter and no exception or waiver applies; or

(iv) subjects a person to undue burden.

(B) If a subpoena

(i) requires disclosure of a trade secret or other confidential research, development, or commercial information, or

(ii) requires disclosure of an unretained expert's opinion or information not describing specific events or occurrences in dispute and resulting from the expert's study made not at the request of any party; or

(iii) requires a person who is not a party or an officer of a party to incur substantial expense to travel more than 100 miles to attend trial, the court may, to protect a person subject

to or affected by the subpoena, quash or modify the subpoena or, if the party in whose behalf the subpoena is issued shows a substantial need for the testimony or material that cannot be otherwise met without undue hardship and assures that the person to whom the subpoena is addressed will be reasonably compensated, the court may order appearance or production only upon specified conditions.

**(D) DUTIES IN RESPONDING TO SUBPOENA**

(1) (A) A person responding to a subpoena to produce documents shall produce them as they are kept in the usual course of business or shall organize and label them to correspond with the categories in the demand.

(B) If a subpoena does not specify the form or forms for producing electronically stored information, a person responding to a subpoena must produce the information in a form or forms in which the person ordinarily maintains it or in a form or forms that are reasonably usable.

(C) A person responding to a subpoena need not produce the same electronically stored information in more than one form.

(D) A person responding to a subpoena need not provide discovery of electronically stored information from sources that the person identifies as not reasonably accessible because of undue burden or cost. On motion to compel discovery or to quash, the person from whom discovery is sought must show that the information sought is not reasonably accessible because of undue burden or cost. If that showing is made, the court may nonetheless order discovery from such sources if the requesting party shows good cause, considering the limitations of Rule 26(b)(2)(C). The court may specify conditions for the discovery.

(2) (A) When information subject to a subpoena is withheld on a claim that it is privileged or subject to protection as trial-preparation materials, the claim shall be made expressly and shall be supported by a description of the nature of the documents, communications, or things not produced that is sufficient to enable the demanding party to contest the claim.

(B) If information is produced in response to a subpoena that is subject to a claim of privilege or of protection as trial-preparation material, the person making the claim may notify any party that received the information of the claim and the basis for it. After being notified, a party must promptly return, sequester, or destroy the specified information and any copies it has and may not use or disclose the information until the claim is resolved. A receiving party may promptly present the information to the court under seal for a determination of the claim. If the receiving party disclosed the information before being notified, it must take reasonable steps to retrieve it. The person who produced the information must preserve the information until the claim is resolved.

(c) CONTEMPT. Failure of any person without adequate excuse to obey a subpoena served upon that person may be deemed a contempt of the court from which the subpoena issued. An adequate cause for failure to obey exists when a subpoena purports to require a nonparty to attend or produce at a place not within the limits provided by clause (ii) of subparagraph (c)(3)(A).

**Attachment A**

**Instructions**

1. If you object to any part of a request and refuse to answer that part, state your objection and answer the remaining portion of that request.

If you object to the scope or time period of a request and refuse to answer for that scope or time period, state your objection and answer the request for the scope or time period you believe is appropriate (including in your answer a specific statement as to why you believe the scope or time period is inappropriate).

2. If any of the following requests cannot be answered in full after exercising due diligence to secure the information, please so state and answer to the extent possible, specifying your inability to answer the remainder and stating whatever information you have concerning the unanswered portions. If your answer is qualified in any particular, set forth the details of such qualification.

3. You must produce all documents responsive to these requests which are in your actual or constructive possession, custody or control, including all documents within the actual or constructive possession, custody or control of any representative, agent, employee, attorney, accountant, investigator or any person acting for you or on your behalf.



4. All documents are to be produced as they are kept in the usual course of business, in the files in which such documents have been maintained, and in the order within each file in which such documents have been maintained; or all documents shall be organized and labeled to correspond with the requests below. All documents are to be produced along with copies of the file folders in which they are kept.

5. If, in responding to the requests, you claim that there is any ambiguity in either a particular request or in a definition or an instruction applicable thereto, such claim shall not be used by you as a basis for refusing to respond, but you shall set forth as part of the response the language deemed to be ambiguous and the interpretation chosen or used in responding to the particular request.

6. For purposes of interpreting or construing the following requests, the terms used are to be given their most expansive and inclusive interpretation unless otherwise specifically limited in the document request itself. This includes, without limitation, the following:

- a. Construing the words "and" and "or" used in any document request in the disjunctive or conjunctive as necessary, to make the document request more inclusive;

- b. Construing the words "any" and "all" used in any document request to mean "any and all" as necessary to make the document request more inclusive;
- c. Construing the singular form of any word to include the plural and the plural form to include the singular; and
- d. Construing the masculine form to include the feminine and/or the gender neutral form.

7. Electronic records and computerized information are to be produced in an intelligible format together with a description of the system from which it is derived sufficient to permit rendering the material intelligible.

**Definitions**

1. The term "relating to" means referring to, regarding, evidencing, describing, supporting, refuting, and/or constituting.

2. The term "document" or "documents" means and includes any kind of written, typewritten or printed materials; any tangible recording of any form of statement, communication or representation; and all other data compilation from which information can be obtained (translated, if necessary, by you through detection devices into reasonably usable form) including, but not limited to, writings and all non-identical copies and drafts

thereof, notes, memoranda, letters, calendars, appointment books, diaries, notes or minutes of meetings or conversations, catalogs, written agreements, microfilm, graphs, charts, drawings, plans, computer discs, computer tapes, computer cards, computer printouts, tape and sound records, photo records, inter-office communications, reports, photographs, cables, telegrams, telexes, account books, ledger sheets, canceled checks, invoices, bills, receipts, financial statements or any other form of “writing” as defined in Federal Rule of Evidence 1001.

3. The term “TFT-LCD module” means thin film transistor liquid crystal display module.

4. The term “mounting hole” means a hole, such as a screw hole, used for mounting or attaching the TFT-LCD module to equipment or to another component, such as a housing.

5. The term “communications” means every manner of disclosure, transfer or exchange of information, whether person to person, in a group, orally, in writing, by telephone, by electronic transmission, or otherwise, including letter or other correspondence, electronic mail, telephone message, memorandum, or telegram.

6. The term “NEC” means NEC Electronics America, Inc., its parents, subsidiaries, affiliated companies, officers, directors, employees, agents, consultants, and all those acting on their behalf.

7. The term “NEC products” means the NEC NL3224AC35-01, NL3224AC35-06, NL3224AC35-09, and NL3224AC35-10.

**Documents to be Produced**

1. Documents relating to the incorporation of the NEC NL3224AC35-01 in a Deutsch Telecom product, including assembly drawings, technical specifications, diagrams, and/or manuals that were dated, published, created or disseminated prior to April 2, 1998.

2. Documents sufficient to show sales, offers to sell or shipments of the NEC NL3224AC35-01 to Deutsch Telecom or its affiliated entities which took place in the United States prior to April 2, 1998.

3. Assembly drawings, technical specifications, diagrams, and/or manuals for the NEC products that were dated, published, created or disseminated prior to April 2, 1998.

4. Documents sufficient to show sales in the United States of the NEC products that occurred prior to April 2, 1998, including sales agreements, purchase orders, and shipping and delivery records.

5. Documents relating to offers to sell, offers to buy, sales solicitation, sales inquiry, quotations, requests for quote, or requests for proposal that were created, dated, published or disseminated prior to April 2, 1998 regarding the NEC products.

6. Sell sheets and advertising materials dated, created, published or disseminated prior to April 2, 1998 regarding the NEC products.

**Deposition Topics**

1. The mechanical structure of the NEC products, including the location of mounting holes on each product.

2. The components that make up the NEC products and the functions of each component.

3. The sale or offer for sale in the United States of the NEC products prior to April 2, 1998.

4. The customers who purchased the NEC products in the United States prior to April 2, 1998.

5. The manners in which the NEC products were used.

6. The dissemination or publication of documents, including specifications, relating to the NEC products prior to April 2, 1998.

7. The manufacture, sale and use of the NEC products.

8. The advertising in the United States of the NEC products prior to April 2, 1998.

9. The public display, including display at trade shows in the United States, of the NEC products prior to April 2, 1998.

10. The documents produced by NEC in this case.

11. The mechanical structure, including the location of mounting holes, of the NEC product depicted in Exhibit A.

12. The sale or offer for sale in the United States of the product depicted in Exhibit A.

13. The advertising, public display or use in the United States of the product depicted in Exhibit A.

14. The dates on which Exhibit A was created, published or disseminated.

15. The mechanical structure, including the location of mounting holes, of the NEC product depicted in Exhibit B.

16. The sale or offer for sale in the United States of the product depicted in Exhibit B.

17. The advertising, public display or use in the United States of the product depicted in Exhibit B.

18. The dates on which Exhibit B was created, published or disseminated.

19. The dates on which the NEC products were manufactured, assembled or ready for sale.

**EXHIBIT A**



DATA SHEET

**NEC**

**TFT COLOR LCD MODULE**  
**NL3224AC35-01**

**14 cm (5.5 Type), 320 × 240 Pixels, Full color**  
**NTSC/PAL mode, Incorporated backlight with inverter**

NL3224AC35-01 is a TFT (thin film transistor) active matrix color liquid crystal display (LCD) comprising amorphous silicon TFT attached to each signal electrode, a driving circuit and a backlight. NL3224AC35-01 has a built-in backlight.

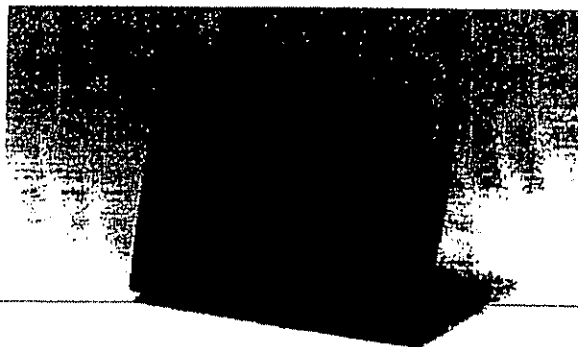
The 14 cm diagonal display area contains 320×240 pixels and can display full-color simultaneously.

**1. FEATURES**

- Analog RGB interface
- Low reflection
- High luminance
- NTSC/PAL mode
- Reversible horizontal and vertical scanning
- 234/240 line display
- Incorporated edge type backlight
- Designed viewing direction: 10 and 2 o'clock

**2. APPLICATIONS**

- Car navigations
- TV monitors
- Video games
- Monitors for process controller



**NL3224AC35-01****NEC****3. STRUCTURE AND FUNCTIONS**

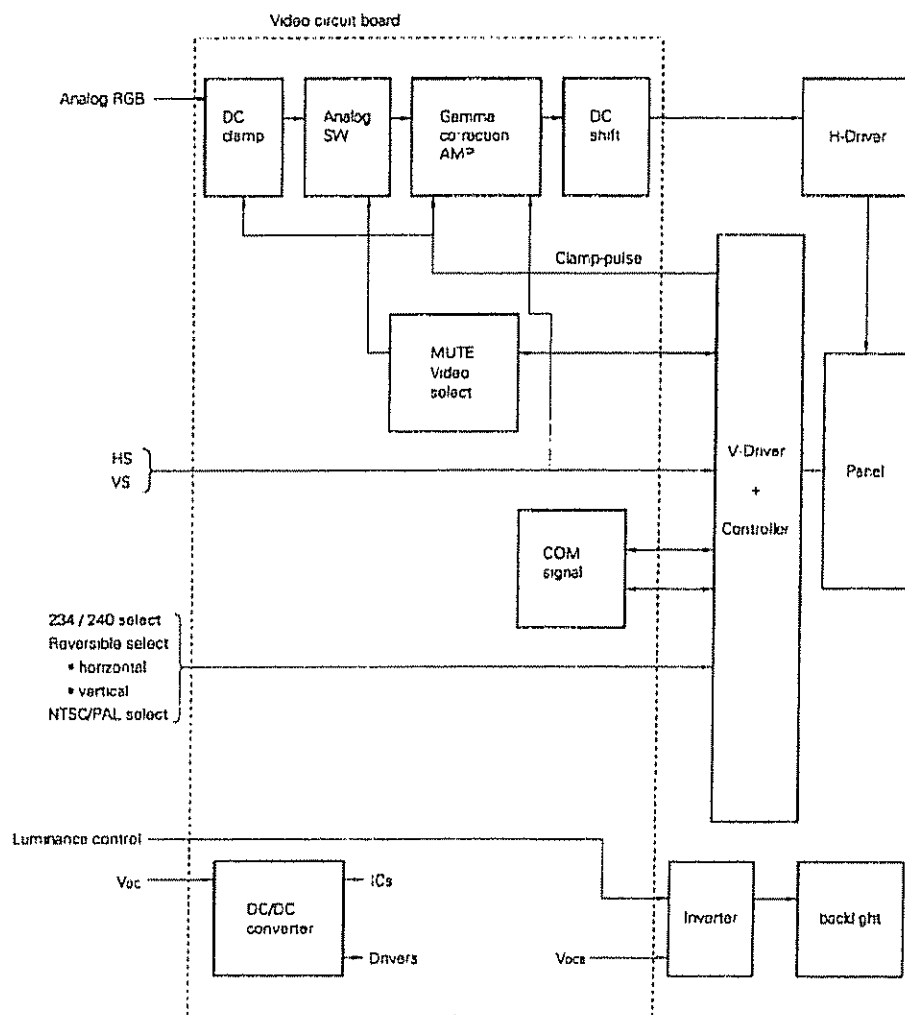
A TFT color LCD module comprises a TFT LCD panel, LSIs for driving liquid crystal, and a backlight. The TFT LCD panel is composed of a TFT array glass substrate superimposed on a color filter glass substrate with liquid crystal filled in the narrow gap between two substrates. The backlight apparatus is located on the backside of the LCD panel.

RGB (Red, Green, Blue) data signals are sent to LCD panel drivers after modulation into suitable forms for active matrix addressing through signal processor.

Each of the liquid crystal cells acts as an electro-optical switch that controls the light transmission from the backlight by a signal applied to a signal electrode through the TFT switch.

**4. OUTLINE OF CHARACTERISTICS (at room temperature)**

|  |   |
|--|---|
| Display area   | 111.36 (H) × 83.52 (V) mm                                 |
| Drive system   | a-Si TFT active matrix                                    |
| Display colors   | Full-color  |
| Number of pixels   | 320 × 240   |
| Pixel arrangement  | RGB vertical stripe                                       |
| Pixel pitch  | 0.348 (H) × 0.348 (V) mm                                  |
| Module size  | 134.0 (H) × 110.0 (V) × 23.0 max (D) mm                   |
| Weight   | 315 g (typ.)  |
| Contrast ratio   | 85:1 (typ.)   |
| Viewing angle (more than the contrast ratio of 10:1)                 |   |
| • Horizontal: 45° (typ. left side, right side)                       |   |
| • Vertical: 30° (typ. up side), 15° (typ. down side)                 |   |
| Designed viewing direction   |   |
| • wider viewing angle with contrast ratio : 10 and 2 o'clock         |   |
| • wider viewing angle without image reversal : down side (6 o'clock) |   |
| • optimum grayscale (γ=2.2) : perpendicular                          |   |
| Color gamut  | 50% (typ. center, to NTSC)                                |
| Response time  | 50 ms (max.), "white" to "black"                          |
| Luminance  | 250 cd/m <sup>2</sup> (typ.)                              |
| Signal system  | Analog RGB signals, synchronous signals (CLK, HS, VS)     |
| Supply voltage   | 9.5 V (LCD power supply), 9.5 V (Backlight power supply)  |
| Backlight  | Edge light type, one fluorescent lamp (cold cathode type) |
| Power consumption  | 6.6 W (typ.)  |

**NEC****NL3224AC35-01****5. BLOCK DIAGRAM**

3

TDE 004531

## NL3224AC35-01

NEC

## 6. SPECIFICATION

## 6.1 GENERAL SPECIFICATIONS

| Item              | Specifications                                | Unit  |
|-------------------|---|-------|
| Module size       | 134.0±0.5 (H) × 110.0±0.5 (V) × 23.0 max. (D) | mm    |
| Display area      | 111.36 (H) × 83.52 (V)                        | mm    |
| Number of dots    | 320 × 3 (H) × 240 (V)                         | dot   |
| Dot pitch         | 0.116 (H) × 0.348 (V)                         | mm    |
| Pixel pitch       | 0.348 (H) × 0.348 (V)                         | mm    |
| Pixel arrangement | RGB (Red, Green, Blue) vertical stripe        | -     |
| Display colors    | Full-color                                    | color |
| Weight            | 330 (max.)                                    | g     |

note : An inverter is incorporated with the module.

## 6.2 ABSOLUTE MAXIMUM RATINGS

| Parameter               | Symbol  | Ratings      | Unit    | Remarks                           |
|-------------------------|---|--------------|---------|-----------------------------------|
| Supply voltage          | V <sub>cc</sub>   | -0.5 to 20.0 | V       | Ta=25°C                           |
|                         | V <sub>cca</sub>  | -0.5 to 20.0 | V       |                                   |
| Analog RGB Input signal | V <sub>in1</sub>  | -2.5 to 2.5  | V       | Ta=25°C<br>V <sub>cc</sub> =9.5 V |
| Logic Input voltage     | V <sub>in2</sub>  | -0.5 to 5.5  | V       |                                   |
| Storage temp.           | T <sub>st</sub>   | -40 to 85    | °C      | —                                 |
| Operating temp.         | T <sub>op</sub>   | -30 to 85    | °C      | Module surface*                   |
| Humidity                | 95% relative humidity   |              | Ta=40°C | no condensation                   |
|                         | 85% relative humidity   |              | Ta=50°C |                                   |
|                         | Absolute humidity shall not exceed<br>Ta=50°C, 85% relative humidity level. |              | Ta>60°C |                                   |

\* measured at the center of the display area

## 6.3 ELECTRICAL CHARACTERISTICS

## (1) Power supply, logic input

Ta = 25°C

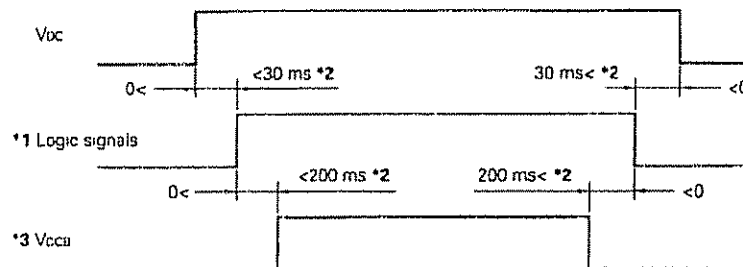
| Parameter                | Symbol           | min. | typ.  | max. | Unit | Remarks   |
|--------------------------|------------------|------|-------|------|------|---|
| Supply voltage           | V <sub>cc</sub>  | 8.0  | 9.5   | 13.0 | V    | For processor, controller and driver                |
|                          | V <sub>cca</sub> | 8.0  | 9.5   | 13.0 | V    | For backlight                                       |
| Logic input "L" voltage  | V <sub>il</sub>  | 0    | —     | 0.9  | V    | —   |
| Logic input "H" voltage  | V <sub>ih</sub>  | 3.15 | —     | 5.0  | V    |   |
| Logic output "L" voltage | V <sub>ol</sub>  | 0    | —     | 0.3  | V    |   |
| Logic output "H" voltage | V <sub>oh</sub>  | 4.5  | —     | 5.0  | V    |   |
| Supply current           | I <sub>bc</sub>  | —    | (147) | 200  | mA   | At dot-checked pattern<br>(V <sub>cc</sub> = 9.5 V) |
|                          | I <sub>bcs</sub> | —    | (541) | 600  | mA   | Maximum luminance<br>(V <sub>cca</sub> = 9.5 V)     |

TDE 004632

**NEC****NL3224AC35-01****(2) Analog RGB signals**

Ta = 25°C

| Parameter                                | min. | typ. | max. | Unit | Remarks   |
|--|------|------|------|------|-----------|
| Analog RGB input voltage (white - black) | 0    | —    | 0.7  | Vp-p | Zi = 75 Ω |
| DC input level (black level)             | 1.0  | —    | 1.0  | V    |           |

**6.4 SUPPLY VOLTAGE SEQUENCE**

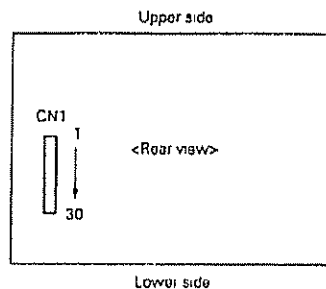
- \* 1 When the Vbc is off, please keep whole logic signals low level
- \* 2 Reference value
- \* 3 Apply Vbcu within the LCD operation period. When the backlight turns on before LCD operation or the LCD operation turns off before the backlight turns off, the display may momentarily become white

**NL3224AC35-01****NEC****6.5 INTERFACE PIN CONNECTION****(1) Connector (CN1)**

Part no : 52610-3017  
 Supplier : Molex  
 Adaptable cable : SUMI-CARD 1.0 mm pitch 30 wick 85°C quality  
 Supplier : SUMITOMO ELECTRIC INDUSTRIES, LTD.

| Pin No. | Symbol           | Pin No. | Symbol           | Pin No. | Symbol |
|---------|------------------|---------|------------------|---------|--------|
| 1       | GNDD             | 11      | EXTCSL           | 21      | GNDD   |
| 2       | EXTCLK           | 12      | GNDD             | 22      | GNDD   |
| 3       | GNDD             | 13      | N/P              | 23      | GNDD   |
| 4       | HS               | 14      | MTSL             | 24      | GNDA   |
| 5       | VS               | 15      | U/D              | 25      | R      |
| 6       | I-OUT            | 16      | R/L              | 26      | GNDA   |
| 7       | VOUT             | 17      | GNDD             | 27      | G      |
| 8       | B <sub>1-3</sub> | 18      | V <sub>CC</sub>  | 28      | GNDA   |
| 9       | GNDD             | 19      | V <sub>CCW</sub> | 29      | B      |
| 10      | GNDD             | 20      | V <sub>DC</sub>  | 30      | GNDA   |

&lt;Connector location&gt;



**NEC****NL3224AC35-01****5.6 PIN DESCRIPTION**

| Symbol | In/Out | Logic    | Description   |
|--------|--------|----------|---|
| R      | In     | —        | Analog Red signal 0.7 Vp-p Zi=75 Ω  |
| G      | In     | —        | Analog Green signal 0.7 Vp-p Zi=75 Ω  |
| B      | In     | —        | Analog Blue signal 0.7 Vp-p Zi=75 Ω   |
| EXTCLK | In *1  | Negative | External clock<br>EXTCLK becomes active, when EXTCSL is "H".  |
| HS     | In *1  | Negative | Horizontal synchronous signal   |
| VS     | In *1  | Negative | Vertical synchronous signal   |
| HOUT   | Out *1 | Negative | Horizontal synchronous signal output  |
| VOUT   | Out *1 | Negative | Vertical synchronous signal output  |
| EXTCSL | In *1  | —        | Clock select signal { H : external clock<br>Default value is L L : internal clock   |
| R/L    | In *1  | —        | Horizontal scanning select signal { H : Right scanning<br>Default value is L L : Left scanning                                  |
| U/D    | In *1  | —        | Vertical scanning select signal { H : down scanning<br>Default value is L L : up scanning                                       |
| N/P    | In *1  | —        | Display mode select { H : PAL mode<br>Default value is L L : NTSC mode  |
| MTSL   | In *1  | —        | Vertical display area select signal { H : 240 lines<br>Default value is L L : 234 lines   |
| Brls   | In *1  | —        | Luminance control signal (pulse input)<br>Luminance is controlled by the pulse width.<br>Duty 100%: luminance max. Refer to P13 |
| Vcc    | In     | —        | Power supply for processor, controller and driver (+9.5 V)  |
| Vccs   | In     | —        | Power supply for backlight (+9.5 V)   |
| GNDA   | —      | —        | Ground for analog RGB signal  |
| GNDD   | —      | —        | Ground for logic and backlight  |

\*1 : CMOS level

**6.7 SIGNALS**

| No. | Functions                      | Description   |
|-----|--------------------------------|---|
| 1   | Reversible horizontal scanning | R/L signal is able to reverse scanning direction.<br>(Right → Left or Left → Right)   |
| 2   | Reversible vertical scanning   | U/D signal is able to reverse scanning direction.<br>(Up → Down or Down → Up)   |
| 3   | NTSC/PAL mode                  | N/P signal is able to change operating mode.<br>(NTSC → PAL or PAL → NTSC)<br>Scanning line is thinned out at the rate of seven to six lines in the PAL mode. |
| 4   | 234/240 line display           | MTSL signal is able to change scanning line.<br>(234 lines → 240 lines or 240 lines → 234 lines)  |

TDE 004535

**NL3224AC35-01****NEC****6.8 INPUT SIGNAL TIMING****(1) mode: NTSC, internal CLK**

| Parameter | Symbol                              | min.     | typ.           | max.           | Unit      | Remarks              |
|-----------|-------------------------------------|----------|----------------|----------------|-----------|----------------------|
| CLK       | Frequency                           | 1 / tc   | 6.36<br>157.32 | --             | MHz<br>ns | --                   |
|           | Rise/fall                           | tcrf     | --             | 70             | ns        | --                   |
|           | Duty                                | tch / tc | 0.4<br>0.5     | 0.6            | --        | --                   |
| HS        | Frequency                           | th       | 60.38<br>--    | 63.56<br>404   | μs<br>CLK | 15.734 kHz<br>(typ.) |
|           | Display                             | thd      | --<br>--       | 60.34<br>320   | μs<br>CLK | --                   |
|           | Pulse-width                         | thp      | 1.0<br>--      | 4.7<br>30      | μs<br>CLK | --                   |
|           | Pulse-width<br>+ back-porch         | thpb     | --             | 11.01          | μs        | 234 line             |
|           |                                     |          | --             | 70             | CLK       | --                   |
|           |                                     |          | --             | 12.11          | μs        | 240 line             |
|           | CLK-Hsync timing<br>hold/setup time | thch     | 10.0           | --             | ns        | --                   |
|           |                                     | thcs     | 10.0           | --             | ns        | --                   |
|           | V-Hsync timing<br>hold/setup time   | thvh     | 1              | --             | CLK       | --                   |
|           |                                     | thvs     | 10.0           | --             | ns        | --                   |
| VS        | Rise/fall                           | thrf     | --             | --             | 10.0      | ns                   |
|           | Frequency                           | tv       | 15.85<br>--    | 16.68<br>282.5 | ms<br>H   | 59.94 Hz<br>(typ.)   |
|           | Display                             | tvd      | --             | 14.87          | ms        | 234 line             |
|           |                                     |          | --             | 234            | H         | --                   |
|           |                                     |          | --             | 15.25          | ms        | 240 line             |
|           | Pulse-width                         | tvp      | 158.89<br>--   | 190.67<br>3    | μs<br>H   | --                   |
|           |                                     |          | --             | --             | --        | --                   |
|           | Pulse-width<br>+ back-porch         | tvpb     | --             | 1.33<br>21     | ms<br>H   | --                   |
|           | Rise/fall                           | tvrf     | --             | --             | 10.0      | ns                   |

note 1 : In the display start period (pulse-width + back porch), analog RGB signals should be blanking level.



**NEC****NL3224AC35-01**

(2) mode: PAL, internal CLK

|     | Parameter                | Symbol   | min.   | typ.   | max.  | Unit | Remarks    |
|-----|--------------------------|----------|--------|--------|-------|------|------------|
| CLK | Frequency                | 1 / to   | --     | 6.45   | --    | MHz  | --         |
|     |                          |          | --     | 154.96 | --    | ns   | --         |
|     | Rise/fall                | trf      | --     | --     | 70    | ns   | --         |
|     | Duty                     | tch / tc | 0.4    | 0.5    | 0.6   | --   | --         |
| HS  | Frequency                | fh       | 60.80  | 64.00  | 67.20 | μs   | 15.625 kHz |
|     |                          |          | --     | 413    | --    | CLK  | (typ.)     |
|     | Display                  | thd      | --     | 49.60  | --    | μs   | --         |
|     |                          |          | --     | 320    | --    | CLK  | --         |
|     | Pulse-width              | thp      | 1.0    | 4.7    | --    | μs   | --         |
|     |                          |          | --     | 30     | --    | CLK  | --         |
|     | Pulse-width + back-porch | thpb     | --     | 11.93  | --    | μs   | 234 line   |
|     |                          |          | --     | 77     | --    | CLK  | --         |
|     |                          |          | --     | 12.71  | --    | μs   | 240 line   |
|     |                          |          | --     | 82     | --    | CLK  | --         |
|     | CLK-Hsync timing         | thch     | 10.0   | --     | --    | ns   | --         |
|     | hold/setup time          | thcs     | 10.0   | --     | --    | ns   | --         |
| VS  | V-Hsync timing           | thvh     | 1      | --     | --    | CLK  | --         |
|     | hold/setup time          | thvs     | 10.0   | --     | --    | ns   | --         |
|     | Rise/fall                | thrf     | --     | --     | 10.0  | ns   | --         |
|     | Frequency                | tv       | 19.00  | 20.00  | 21.00 | ms   | 50.00 Hz   |
|     |                          |          | --     | 312.5  | --    | H    | (typ.)     |
|     | Display                  | tvd      | --     | 17.47  | --    | ms   | 234 line   |
|     |                          |          | --     | 273    | --    | H    | --         |
|     |                          |          | --     | 17.92  | --    | ms   | 240 line   |
|     |                          |          | --     | 280    | --    | H    | --         |
|     | Pulse-width              | tvp      | 153.60 | 192.00 | --    | μs   | --         |
|     |                          |          | --     | 2.5    | --    | H    | --         |
|     | Pulse-width + back-porch | tvpb     | --     | 1.86   | --    | ms   | 234 line   |
|     |                          |          | --     | 29     | --    | H    | --         |
|     |                          |          | --     | 1.66   | --    | ms   | 240 line   |
|     |                          |          | --     | 28     | --    | H    | --         |
|     | Rise/fall                | tvrf     | --     | --     | 10.0  | ns   | --         |

note 1 : In the display start period (pulse-width + back-porch), analog RGB signals should be blanking level

NL3224AC35-01

NEC

(3) mode : NTSC, external CLK

|                   | Parameter                           | Symbol   | min.        | typ.           | max.        | Unit      | Remarks              |
|-------------------|-------------------------------------|----------|-------------|----------------|-------------|-----------|----------------------|
| EXTCLK            | Frequency                           | 1 / tc   | —<br>118.75 | 8.0<br>125.00  | —<br>131.25 | MHz<br>ns | —                    |
|                   | Rise/fall                           | trf      | —           | —              | 10          | ns        | —                    |
|                   | Duty                                | tch / tc | 0.4         | 0.5            | 0.6         | —         | —                    |
| HS                | Frequency                           | th       | 60.38<br>—  | 63.58<br>508   | 66.74<br>—  | μs<br>CLK | 15.734 kHz<br>(typ.) |
|                   | Display                             | thd      | —           | 40.00<br>320   | —           | μs<br>CLK | —                    |
|                   | Pulse-width                         | thp      | 1.0<br>—    | 4.7<br>38      | —           | μs<br>CLK | —                    |
|                   | Pulse-width<br>+ back-porch         | thpo     | —           | 8.75           | —           | μs        | 234 line             |
|                   |                                     |          | —           | 70             | —           | CLK       | —                    |
|                   | Pulse-width<br>+ back-porch         | thpo     | —           | 9.63           | —           | μs        | 240 line             |
|                   |                                     |          | —           | 77             | —           | CLK       | —                    |
|                   | CLK-Hsync timing<br>hold/setup time | thch     | 10.0        | —              | —           | ns        | —                    |
|                   |                                     | rncs     | 10.0        | —              | —           | ns        | —                    |
|                   | V-Hsync timing<br>hold/setup time   | thvh     | 1           | —              | —           | CLK       | —                    |
|                   |                                     | thvs     | 10.0        | —              | —           | ns        | —                    |
| VS                | Rise/fall                           | thrf     | —           | —              | 10.0        | ns        | —                    |
|                   | Frequency                           | tv       | 15.85<br>—  | 16.60<br>262.5 | 17.51<br>—  | ms<br>H   | 59.94 Hz<br>(typ.)   |
|                   | Display                             | tvd      | —           | 14.87          | —           | ms        | 234 line             |
|                   |                                     |          | —           | 234            | —           | H         | —                    |
|                   |                                     |          | —           | 15.25          | —           | ms        | 240 line             |
|                   | Pulse-width<br>+ back-porch         | tvpb     | —           | 1.33           | —           | ms        | —                    |
|                   |                                     |          | —           | 21             | —           | H         | —                    |
| Analog<br>R, G, B | Rise/fall                           | trrf     | —           | —              | 10.0        | ns        | —                    |
|                   | Setup time                          | tdas     | 10.0        | —              | —           | ns        | —                    |
|                   | Hold time                           | tdah     | 10.0        | —              | —           | ns        | —                    |

note 1 : In the display start period (pulse-width + back-porch), analog RGB signals should be blanking level.

**NEC****NL3224AC35-01****(4) mode : PAL, external CLK**

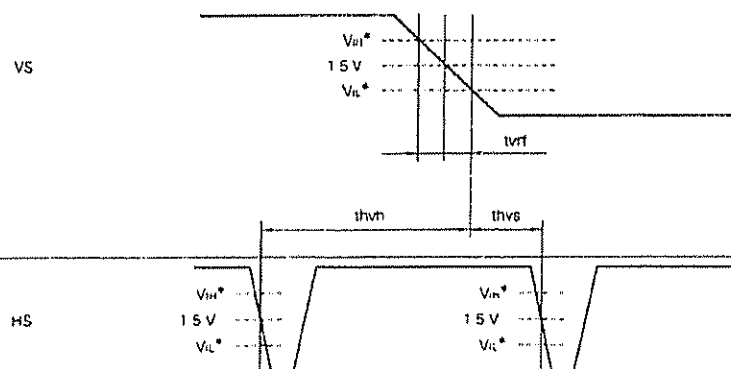
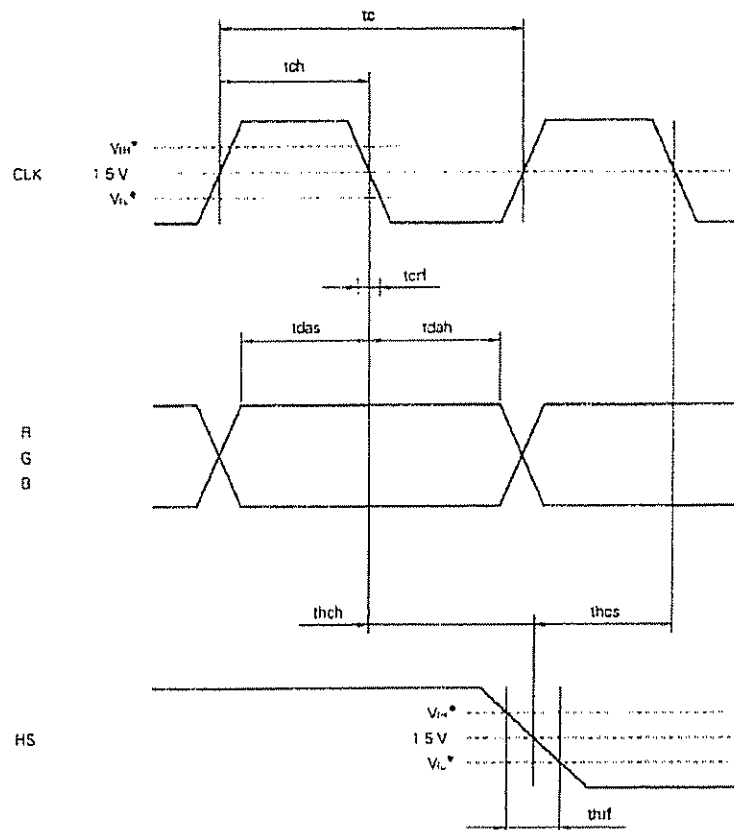
|                   | Parameter                           | Symbol   | min.        | typ.                  | max.        | Unit               | Remarks              |
|-------------------|-------------------------------------|----------|-------------|-----------------------|-------------|--------------------|----------------------|
| EXTCLK            | Frequency                           | 1 / tc   | —<br>118.75 | 8.0<br>125.00         | —<br>131.25 | MHz<br>ns          | —                    |
|                   | Rise/fall                           | tcrf     | —           | —                     | 10          | ns                 | —                    |
|                   | Duty                                | tch / to | 0.4         | 0.5                   | 0.6         | —                  | —                    |
| HS                | Frequency                           | th       | 60.00<br>—  | 64.00<br>512          | 67.20<br>—  | μs<br>CLK          | 15.025 kHz<br>(typ.) |
|                   | Display                             | thd      | —<br>—      | 40.00<br>320          | —<br>—      | μs<br>CLK          | —                    |
|                   | Pulse-width                         | thp      | 1.0<br>—    | 4.7<br>38             | —<br>—      | μs<br>CLK          | —                    |
|                   | Pulse-width<br>+back-porch          | thpb     | —<br>—      | 9.63<br>77            | —<br>—      | μs<br>CLK          | 234 line             |
|                   |                                     |          | —<br>—      | 10.25<br>82           | —<br>—      | μs<br>CLK          | 240 line             |
|                   | CLK-Hsync timing<br>hold/setup time | thch     | 10.0        | —                     | —           | ns                 | —                    |
|                   |                                     | thcs     | 10.0        | —                     | —           | ns                 | —                    |
|                   | V-Hsync timing<br>hold/setup time   | thvh     | 1           | —                     | —           | CLK                | —                    |
|                   |                                     | thvs     | 10.0        | —                     | —           | ns                 | —                    |
|                   | Rise/fall                           | thrf     | —           | —                     | 10.0        | ns                 | —                    |
| VS                | Frequency                           | tv       | 19.00<br>—  | 20.00<br>312.5        | 21.00<br>—  | ms<br>H            | 50.00 Hz<br>(typ.)   |
|                   | Display                             | tvd      | —<br>—<br>— | 17.47<br>273<br>17.92 | —<br>—<br>— | ms<br>H<br>ms<br>H | 234 line<br>240 line |
|                   |                                     |          | —           | 280                   | —           | H                  |                      |
|                   | Pulse-width                         | tvp      | 153.60<br>— | 192.00<br>2.5         | —<br>—      | μs<br>H            | —                    |
|                   | Pulse-width<br>+back-porch          | tvpb     | —<br>—<br>— | 1.85<br>29<br>1.65    | —<br>—<br>— | ms<br>H<br>ms<br>H | 234 line<br>240 line |
|                   |                                     |          | —           | 26                    | —           | H                  |                      |
|                   | Rise/fall                           | tvrf     | —           | —                     | 10.0        | ns                 | —                    |
|                   | Setup time                          | tdas     | 10.0        | —                     | —           | ns                 | —                    |
| Analog<br>R, G, B | Hold time                           | tdah     | 10.0        | —                     | —           | ns                 | —                    |

note 1 : In the display start period (pulse-width + back-porch), analog RGB signals should be blanking level.

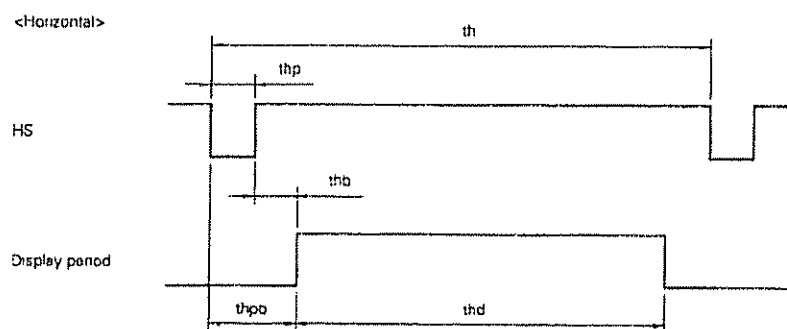
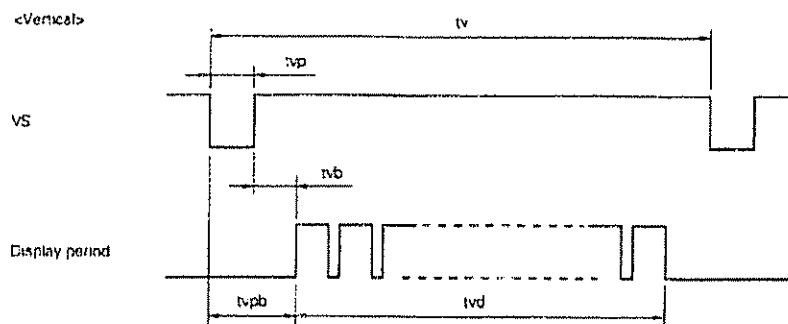
NL3224AC35-01

NEC

## 6.9 DEFINITION OF INPUT SIGNAL TIMING

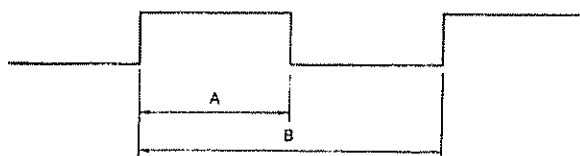


\*  $V_{IH} = 3.15 \text{ V (min.) to } 5.00 \text{ V (max.)}$   
 $V_{IL} = 0.00 \text{ V (min.) to } 0.90 \text{ V (max.)}$

**NEC****NL3224AC35-01**

&lt;Luminance control signal &gt;

BPLS



Pulse A duty 100% Relative luminance 100%  
 Pulse A duty 20% Relative luminance 10% (reference value)

A : 800  $\mu$ s to 3.7 ms  
 B : 3.7 ms  $\pm$  10%

NL3224AC35-01

NEC

## 7. GENERAL CAUTION

**WARNING**

Do not remove the rear case while the LCD module is operating, because dangerous high voltage is generating.

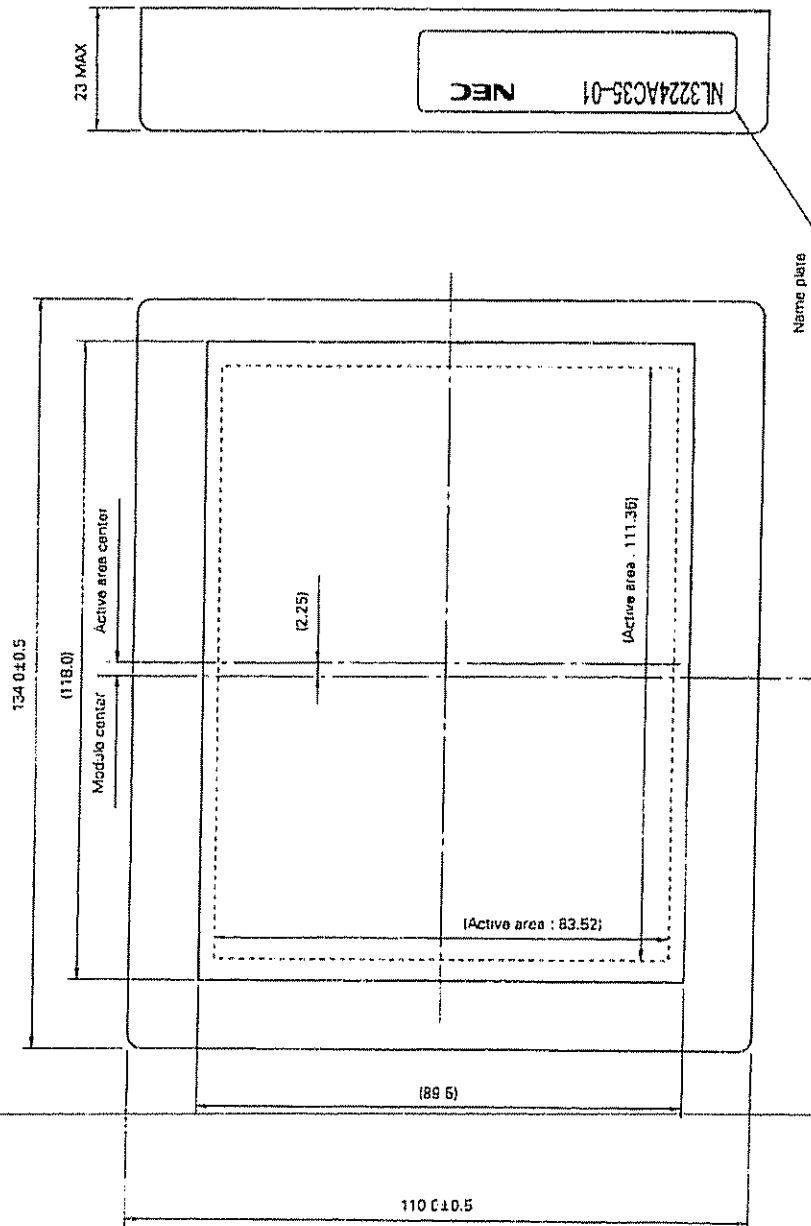
- (1) Caution when taking out the module
  - ① Pick the pouch only, when taking out module from a shipping package.
- (2) Cautions for handling the module
  - ① As the electrostatic discharges may break the LCD module, handle the LCD module with care. Peel a protection sheet off from the LCD panel surface as slowly as possible.
  - ② As the LCD panel and back-light element are made from fragile glass material, impulse and pressure to the LCD module should be avoided.
  - ③ As the surface of polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.
  - ④ Do not pull the interface connectors in or out while the LCD module is operating.
  - ⑤ Put the module display side down on a flat horizontal plane.
  - ⑥ Handle connectors and cables with care.
- (3) Cautions for the operation
  - ① When the module is operating, do not lose CLK, HS, or VS signals. If any one of these signals is lost, the LCD panel would be damaged.
  - ② Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
  - ③ Should not intermittently operate the module. It will be the cause of a short life.
- (4) Cautions for the atmosphere
  - ① Dew drop atmosphere should be avoided.
  - ② Do not store and/or operate the LCD module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.
  - ③ Backlight lamp tend to increase the turn on voltage in a cold atmosphere. And the life of module will become short.
- (5) Cautions for the module characteristics
  - ① Do not apply fixed pattern data signal to the LCD module at product aging. Applying fixed pattern for a long time may cause image sticking.
- (6) Other cautions
  - ① Do not disassemble and/or re-assemble LCD module.
  - ② Do not re-adjust variable resistor or switch etc.
  - ③ When returning the module for repair or etc, Please pack the module not to be broken. We recommend to use the original shipping packages.

Liquid Crystal Display has the following specific characteristics. There are not defects or malfunctions. The display condition of LCD module may be affected by the ambient temperature. The LCD module uses cold cathode tubes for backlighting. Optical characteristics, like luminance or uniformity, will change during time. Uneven brightness and/or small spots may be noticed depending on different display patterns.

NEC

NL3224AC35-01

OUTLINE DRAWING (Unit in mm) Front view



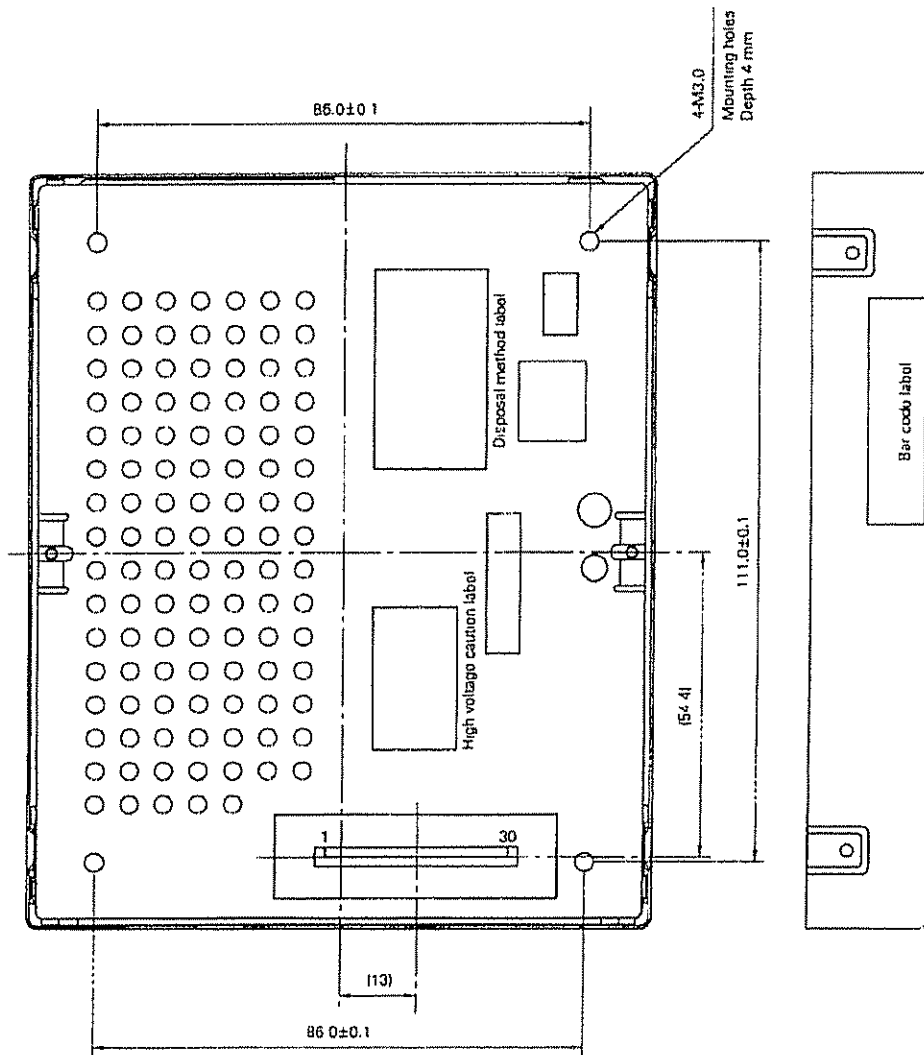
15

TDE 004543

NL3224AC35-01

NEC

OUTLINE DRAWING (Unit in mm) Rear view





**NEC**

**NL3224AC35-01**

---

**NL3224AC35-01**

**NEC**

---

**NEC**

**NL3224AC35-01**

---

NL3224AC35-01

NEC

---

No part of this document may be copied in any form or by any means without the prior written consent of NEC Corporation.  
NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.

---

TDE 004548

## **EXHIBIT B**

DATA SHEET

**NEC**

TFT COLOR LCD MODULE  
**NL3224AC35-06**

14 cm (5.5 Type), 320 × 240 Pixels, Full color, RGB separate input  
NTSC Composite input, Incorporated backlight with inverter

NL3224AC35-06 is a TFT (thin film transistor) active matrix color liquid crystal display (LCD) comprising amorphous silicon TFT attached to each signal electrode, a driving circuit and a backlight. NL3224AC35-06 has a built-in backlight.

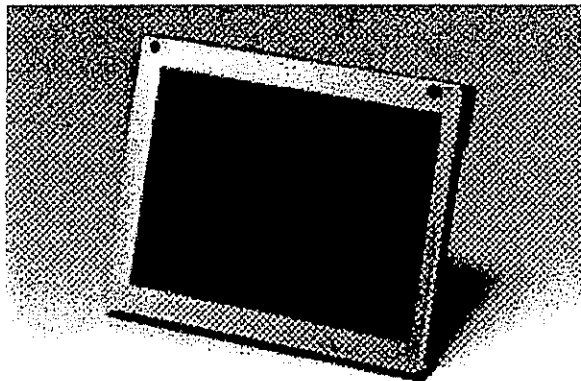
The 14 cm diagonal display area contains 320×240 pixels and can display full-color simultaneously.

**1. FEATURES**

- Full color
- Analog RGB interface
- NTSC Composite input
- Low reflection
- High luminance
- Reversible horizontal and vertical scanning
- 234/240 line display
- Incorporated edge type backlight
- Designed viewing direction: 10 and 2 o'clock
- Replaceable backlight

**2. APPLICATIONS**

- Car navigations
- TV monitors
- Video games
- Monitors for process controller



The information in this document is subject to change without notice

## NL3224AC35-06

NEC

## 3 STRUCTURE AND FUNCTIONS

A TFT color LCD module comprises a TFT LCD panel, LSIs for driving liquid crystal, and a backlight. The TFT LCD panel is composed of a TFT array glass substrate superimposed on a color filter glass substrate with liquid crystal filled in the narrow gap between two substrates. The backlight apparatus is located on the backside of the LCD panel.

RGB (Red, Green, Blue) data signals are sent to LCD panel drivers after modulation into suitable forms for active matrix addressing through signal processor.

Each of the liquid crystal cells acts as an electro-optical switch that controls the light transmission from the backlight by a signal applied to a signal electrode through the TFT switch.

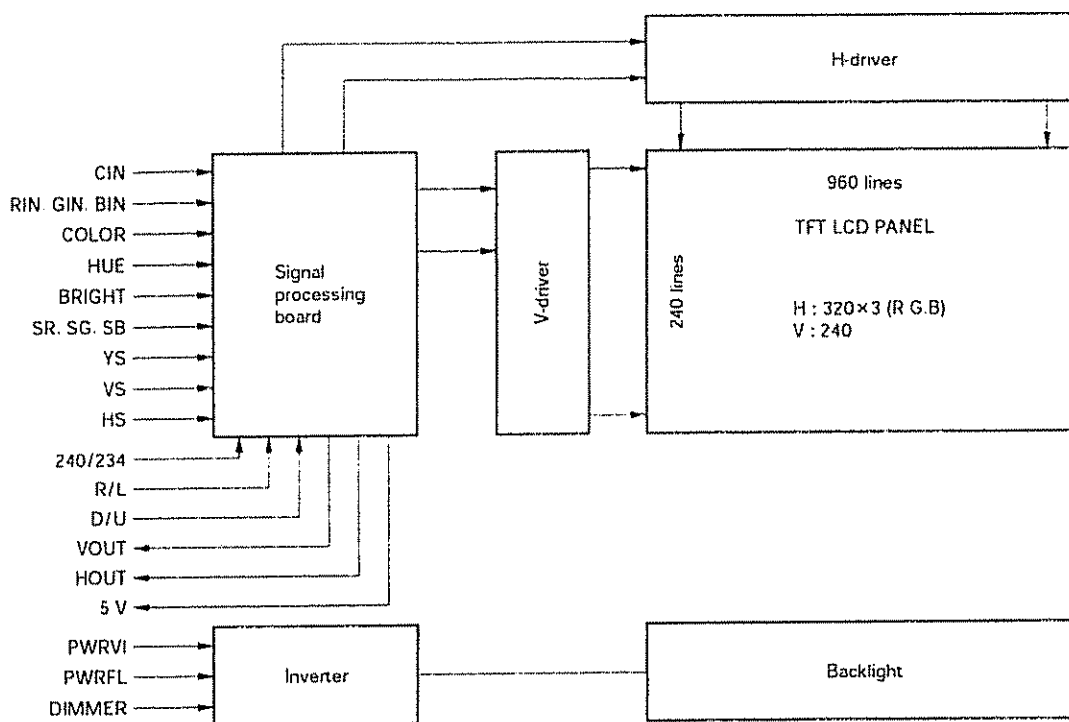
## 4 OUTLINE OF CHARACTERISTICS (at room temperature)

|   |  |
|---|--|
| Display area  | 111.36 (H) × 83.52 (V) mm  |
| Drive system  | a-Si TFT active matrix   |
| Display colors  | Full-color   |
| Number of pixels  | 320 × 240  |
| Pixel arrangement   | RGB vertical stripe  |
| Pixel pitch   | 0.348 (H) × 0.348 (V) mm   |
| Module size   | 134.0 (H) × 110.0 (V) × 16.5 max.(D) mm                                  |
| Weight  | 285 g (typ.)   |
| Contrast ratio  | 85:1 (typ.)  |
| Viewing angle (more than the contrast ratio of 10:1)                                  |  |
| • Horizontal : 50° (typ. left side, right side) fix down 5° direction                 |  |
| • Vertical : 25° (typ. up side), 25° (typ. down side) fix left or right 30° direction |  |
| Designed viewing direction  |  |
| • wider viewing angle with contrast ratio : down side (6 o'clock)                     |  |
| • wider viewing angle without image reversal : up side (2 and 10 o'clock)             |  |
| • optimum grayscale (γ=2.2) : perpendicular   |  |
| Color gamut   | 50% (typ. center to NTSC)  |
| Response time   | 60 ms (max.), "white" to "black"   |
| Luminance   | 250 cd/m <sup>2</sup> (typ.)   |
| Signal system   | Analog RGB signals, synchronous signals (Hsync, Vsync), composite signal |
| Supply voltage  | 9.5 V × 2  |
| Backlight   | Edge light type, one fluorescent lamp (cold cathode type)                |
| Power consumption   | 8.0 W (typ.)   |

# NEC

NL3224AC35-06

## 5 BLOCK DIAGRAM





NL3224AC35-06

NEC

## 6. SPECIFICATION

## 6.1 GENERAL SPECIFICATIONS

| Item              | Specifications                                | Unit  |
|-------------------|---|-------|
| Module size       | 134.0±0.5 (H) × 110.0±0.5 (V) × 16.5 max. (D) | mm    |
| Display area      | 111.36 (H) × 83.52 (V)                        | mm    |
| Number of dots    | 320 × 3 (H) × 240 (V)                         | dot   |
| Dot pitch         | 0.116 (H) × 0.348 (V)                         | mm    |
| Pixel pitch       | 0.348 (H) × 0.348 (V)                         | mm    |
| Pixel arrangement | RGB (Red, Green, Blue) vertical stripe        | -     |
| Display colors    | Full-color                                    | color |
| Weight            | 330 (max.)                                    | g     |

note : An inverter is incorporated with the module.

## 6.2 ABSOLUTE MAXIMUM RATINGS

| Parameter                                       | Symbol   | Ratings       | Unit             | Remark          |
|---|--|---------------|------------------|-----------------|
| Supply voltage                                  | V <sub>VI</sub>  | -0.3 to +20.0 | V                | Ta=25°C         |
|   | V <sub>FL</sub>  | -0.3 to +20.0 | V                |                 |
| Composite RGB input signal                      | V <sub>CIH-RGB</sub>   | 2.0           | V <sub>P-P</sub> |                 |
|   | V <sub>CIH-DC</sub>  | -3.5 to +2.5  | V                |                 |
| Analog RGB input signal                         | V <sub>IHAC</sub>  | 4.0           | V <sub>P-P</sub> |                 |
|   | V <sub>INDC</sub>  | -3.0 to +3.0  | V                |                 |
| DC input voltage (SR, SG, SB 240/234, R/L, D/U) | V <sub>IH1</sub>   | -0.5 to +5.5  | V                |                 |
| DC input voltage (COLOR, HUE BRIGHT, DIMMER)    | V <sub>IH2</sub>   | -0.5 to +5.0  | V                |                 |
| Storage temp.                                   | T <sub>S1</sub>  | -40 to +95    | °C               | —               |
| Operating temp.                                 | T <sub>OP</sub>  | -30 to +85    | °C               | Module surface* |
| Humidity  | ≤ 95% relative humidity  |               | Ta=40°C          | no condensation |
|   | ≤ 85% relative humidity  |               | Ta=50°C          |                 |
|   | Absolute humidity shall not exceed Ta=50°C 85% relative humidity level |               | Ta>50°C          |                 |

\* measured at the center of the display area

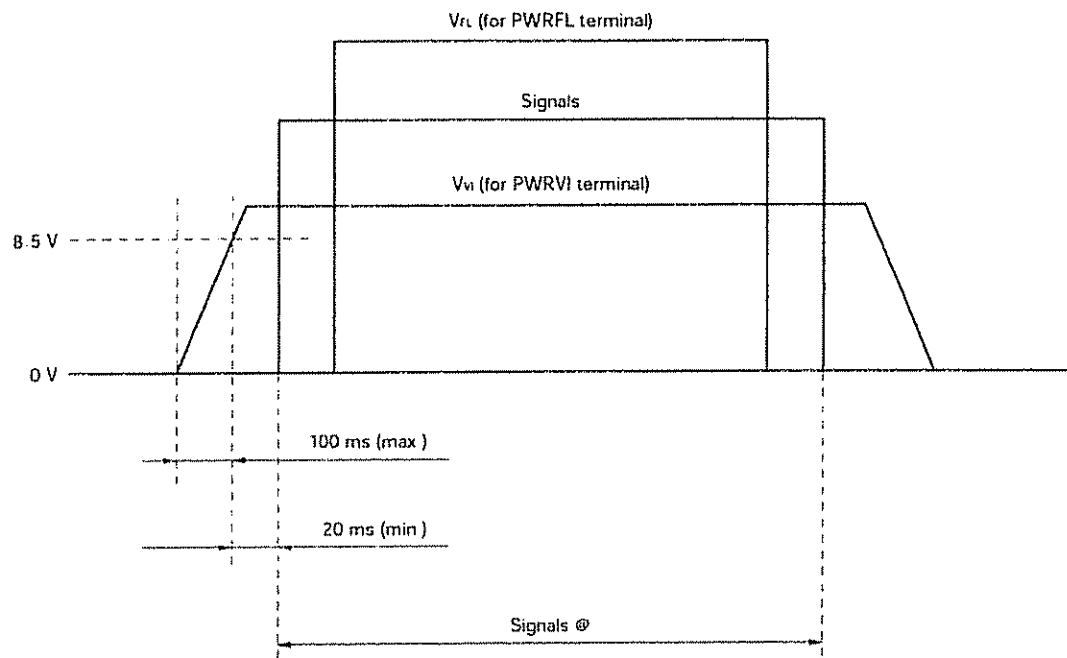
**NEC****NL3224AC35-06****6.3 ELECTRICAL CHARACTERISTICS****(1) Power supply, logic input** $T_a = 25^\circ\text{C}$ 

| Parameter                                   | Symbol         | Min  | Typ. | Max  | Unit             | Remark                          |
|---|----------------|------|------|------|------------------|---------------------------------|
| Supply voltage                              | $V_{VI}$       | 8.5  | 9.5  | 10.5 | V                | for PWRVI terminal              |
|   | $V_{FL}$       | 8.5  | 9.5  | 10.5 | V                | for PWRFL terminal              |
| Composite video signal                      | $V_{CIN}$      | -    | 1.0  | -    | V                | for CIN terminal                |
|   | $V_{CIN\ RGB}$ | -    | 0.7  | -    | V <sub>P-P</sub> | $Z_i = 75\ \Omega$              |
|   | $V_{CIN\ DC}$  | -0.5 | -    | 0.5  | V                |                                 |
| Video signal                                | $V_{IRGB}$     | -    | 0.7  | -    | V <sub>P-P</sub> | for RIN, GIN, BIN terminals     |
|   | $V_{LDC}$      | -1.0 | -    | 1.0  | V                | $Z_i = 75\ \Omega$              |
| Super inpose voltage -ON<br>-OFF            | $V_{IH1}$      | 3.15 | -    | 5.0  | V                | for SR, SG, SB terminals        |
|   | $V_{IL1}$      | 0    | -    | 0.9  | V                | CMOS level                      |
| Logic input voltage -Low<br>-High           | $V_{IL2}$      | 0    | -    | 0.9  | V                | for 240/234, R/L, D/U terminals |
|   | $V_{IH2}$      | 3.15 | -    | 5.0  | V                | CMOS-level                      |
| Super output voltage -Low<br>-High          | $V_{OL2}$      | 0    | -    | 0.9  | V                | for VOUT, HOUT terminals        |
|   | $V_{OH2}$      | 3.15 | -    | 5.0  | V                | CMOS-level                      |
| Supply current<br>(@ dot-checkered pattern) | $I_{VI}$       | -    | 200  | 300  | mA               | @ $V_{VI} = 9.5\ \text{V}$      |
|   | $I_{FL}$       | -    | 640  | 800  | mA               | @ $V_{FL} = 9.5\ \text{V}$      |
| Luminance control range                     | $L_{CNT}$      | 10   | -    | 100  | %                | -                               |

NL3224AC35-06

NEC

## 6.4 SUPPLY VOLTAGE SEQUENCE



@ CIN, RIN, GIN, BIN, SR, SG, SB, COLOR, HUE, BRIGHT,  
DIMMER, 240/234, R/L, D/U

- (1) Apply PWRFL within the LCD operation period. When the backlight turns on before LCD operation or the LCD operation turns off, the display may momentarily become white.
  - (2) When the PWRVI is off, please keep whole logic signals low level.
  - (3) Wrong power sequence may damage to the module
- Attention: As Input V<sub>VI</sub>, reach at 8.5 V within 100 ms (max).

**NEC****NL3224AC35-06****6.5 INTERFACE PIN CONNECTION****(1) Connector 1**

Part No. : IL-402-30S-S1L-SA  
 Supplier : Japan Aviation Electronics Industry Limited (JAE)  
 Adaptable card : SUMI-CARD 1.0 mm pitch 30 wick 85°C quality  
 Supplier : SUMITOMO ELECTRIC INDUSTRIES, LTD.

| Pin No. | Symbol | Pin No. | Symbol | Pin No. | Symbol |
|---------|--------|---------|--------|---------|--------|
| 1       | DIMMER | 11      | AGND   | 21      | VOUT   |
| 2       | PWRFL  | 12      | RIN    | 22      | HOUT   |
| 3       | PWRFL  | 13      | AGND   | 23      | 5 V    |
| 4       | GNDFL  | 14      | GIN    | 24      | COLOR  |
| 5       | GNDFL  | 15      | AGND   | 25      | HUE    |
| 6       | GNDVI  | 16      | BIN    | 26      | BRIGHT |
| 7       | GNDVI  | 17      | AGND   | 27      | GND    |
| 8       | PWRVI  | 18      | YS     | 28      | SR     |
| 9       | PWRVI  | 19      | N C    | 29      | SG     |
| 10      | CIN    | 20      | N C    | 30      | SB     |

note : N C (No Connection) should be open

**(2) Connector 2**

Part No : IL-402-6S-S1L-SA  
 Supplier : Japan Aviation Electronics Industry Limited (JAE)  
 Adaptable card : SUMI-CARD 1.0 mm pitch 6 wick 85°C quality  
 Supplier : SUMITOMO ELECTRIC INDUSTRIES, LTD.

| Pin No. | Symbol | Pin No. | Symbol  | Pin No. | Symbol |
|---------|--------|---------|---------|---------|--------|
| 1       | GNDVI  | 3       | D/U     | 5       | -      |
| 2       | R/L    | 4       | 240/234 | 6       | GNDVI  |

NL3224AC35-06

NEC

## 6 6 PIN DESCRIPTION

## CN1

| Pin No.        | Symbol | I / O  | Logic | Description  |
|----------------|--------|--------|-------|--|
| 10             | CIN    | Input  | Nega. | Composite signal input (1.0 V <sub>pp</sub> , 75 Ω)  |
| 12             | RIN    | Input  | -     | Red video signal input (0.7 V <sub>pp</sub> , 75 Ω)  |
| 14             | GIN    | Input  | -     | Green video signal input (0.7 V <sub>pp</sub> , 75 Ω)  |
| 16             | BIN    | Input  | -     | Blue video signal input (0.7 V <sub>pp</sub> , 75 Ω)   |
| 21             | VOUT   | Output | Nega. | Horizontal synchronous signal output (CMOS level)  |
| 22             | HOUT   | Output | Nega. | Vertical synchronous signal output (CMOS level)  |
| 18             | YS     | Input  | -     | Composite / RGB select signal @<br>H or open : RGB video signal mode<br>L : Composite video signal mode (CMOS level) |
| 28             | SR     | Input  | -     | Super impose red signal input (CMOS level) @<br>H : ON<br>L or open : OFF  |
| 29             | SG     | Input  | -     | Super impose green signal input (CMOS level) @<br>H : ON<br>L or open : OFF  |
| 30             | SB     | Input  | -     | Super impose blue signal input (CMOS level) @<br>H : ON<br>L or open : OFF   |
| 1              | DIMMER | Input  | -     | Dimmer control signal 0.5 V (max) : bright is off<br>1.2 V (dark) to 3.5 V (bright)                                  |
| 24             | COLOR  | Input  | -     | Color control signal : 0 V (light) to 5.0 V (deep)   |
| 25             | HUE    | Input  | -     | Hue control signal : 0 V (reddish) to 5.0 V (greenish) @   |
| 26             | BRIGHT | Input  | -     | Bright control signal : 0 V (bright) to 5.0 V (dark)   |
| 8, 9           | PWRVI  | Input  | -     | Power supply for logic 9.5 V±1 V   |
| 2, 3           | PWRFL  | Input  | -     | Power supply for Backlight 9.5 V±1 V   |
| 23             | 5 V    | Output | -     | DC power output 5.0 V, 10 mA (max)   |
| 6, 7           | GNDVI  | -      | -     | Signal ground for logic  |
| 4, 5           | GNDFL  | -      | -     | Ground for backlight   |
| 11, 13, 15, 17 | AGND   | -      | -     | Ground for analog RGB  |
| 19, 20         | N.C.   | -      | -     | N.C. (No Connection) should be open.   |

@ Permit to use "open mode"

## CN2

| Pin No. | Symbol    | I / O | Logic | Description  |
|---------|-----------|-------|-------|--|
| 1       | GNDFL     | -     | -     | Ground for backlight   |
| 2       | R / L     | Input | -     | Horizontal scanning select signal @<br>H or open : Right scanning<br>L : Left scanning |
| 3       | D / U     | Input | -     | Vertical scanning select signal @<br>H or open : Down scanning<br>L : Up scanning      |
| 4       | 240 / 234 | Input | -     | Vertical display area select signal @<br>H : 240 lines<br>L or open : 234 lines        |

@ Permit to use "open mode"

**NEC****NL3224AC35-06****6.7 INPUT SIGNAL TIMING****1. Composite sync mode****(1) 234 line mode**

|       | Parameter     | Symbol          | Min          | Typ            | Max.         | Unit      | Remark            |
|-------|---------------|-----------------|--------------|----------------|--------------|-----------|-------------------|
| CLK   | Frequency     | 1 / tc          | -            | 157.32         | -            | ns        | 6.3565 MHz        |
| Vsync | Frequency     | tv              | 15.83<br>249 | 16.68<br>262.5 | 17.48<br>275 | ms<br>H   | 59.94 kHz         |
|       | Display start | tv <sub>s</sub> | -            | 1.33<br>21     | -            | ms<br>H   |                   |
|       | Display       | tv <sub>d</sub> | -            | 14.87<br>234   | -            | ms<br>H   |                   |
| Hsync | Frequency     | th              | 61.65        | 63.56<br>404   | 65.47        | μs<br>CLK | 15.734 kHz (typ.) |
|       | Display start | th <sub>s</sub> | -            | 10.38<br>66    | -            | μs<br>CLK |                   |
|       | Display       | th <sub>d</sub> | -            | 50.34<br>320   | -            | μs<br>CLK |                   |
|       | Pulse-width   | th <sub>p</sub> | 4.0          | 4.7            | -            | μs        |                   |
|       | Back-porch    | th <sub>b</sub> | -            | 4.7            | -            | μs        |                   |

**(2) 240 line mode**

|       | Parameter     | Symbol          | Min          | Typ.           | Max.         | Unit      | Remark            |
|-------|---------------|-----------------|--------------|----------------|--------------|-----------|-------------------|
| CLK   | Frequency     | 1 / tc          | -            | 157.32         | -            | ns        | 6.3565 MHz        |
| Vsync | Frequency     | tv              | 15.83<br>259 | 16.68<br>262.5 | 17.48<br>275 | ms<br>H   | 59.94 kHz (typ.)  |
|       | Display start | tv <sub>s</sub> | -            | 1.33<br>21     | -            | ms<br>H   |                   |
|       | Display       | tv <sub>d</sub> | -            | 15.25<br>240   | -            | ms<br>H   |                   |
| Hsync | Frequency     | th              | 61.65<br>-   | 63.56<br>404   | 65.47<br>-   | μs<br>CLK | 15.734 kHz (typ.) |
|       | Display start | th <sub>s</sub> | -            | 10.38<br>66    | -            | μs<br>CLK |                   |
|       | Display       | th <sub>d</sub> | -            | 50.34<br>320   | -            | μs<br>CLK |                   |
|       | Pulse-width   | th <sub>p</sub> | 4.0          | 4.7            | -            | μs        |                   |
|       | Back-porch    | th <sub>b</sub> | -            | 4.7            | -            | μs        |                   |

Only operating functions are evaluated for these modes above.

NL3224AC35-06

NEC

## 2. RGB separate mode

## (1) 234 line mode

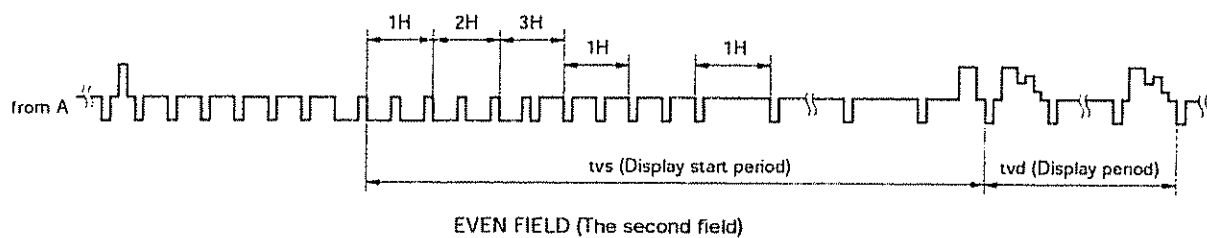
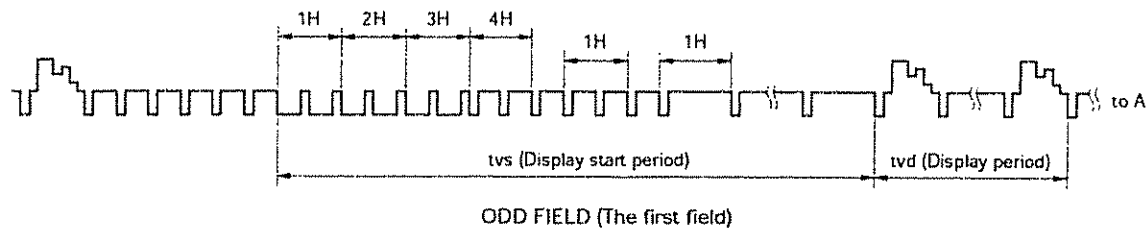
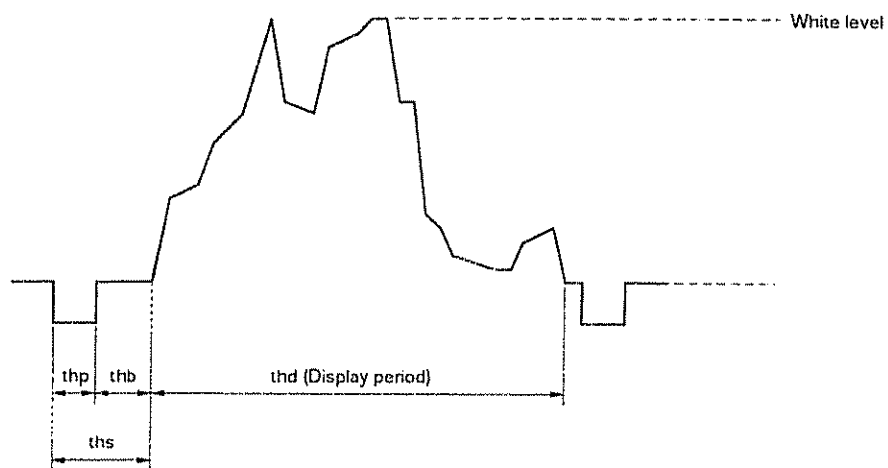
|       | Parameter     | Symbol          | Min.         | Typ            | Max          | Unit      | Remark            |
|-------|---------------|-----------------|--------------|----------------|--------------|-----------|-------------------|
| CLK   | Frequency     | 1 / tc          | -            | 157.32         | -            | ns        | 6.3565 MHz        |
| Vsync | Frequency     | tv              | 15.83<br>249 | 16.68<br>262.5 | 17.48<br>275 | ms<br>H   | 59.94 kHz (typ.)  |
|       | Display start | tv <sub>s</sub> | -            | 1.33<br>21     | -            | ms<br>H   | -                 |
|       | Display       | tv <sub>d</sub> | -            | 14.87<br>234   | -            | ms<br>H   | -                 |
| Hsync | Frequency     | th              | 61.65<br>-   | 63.56<br>404   | 65.47<br>-   | μs<br>CLK | 15.734 kHz (typ.) |
|       | Display start | th <sub>s</sub> | -            | 11.01<br>70    | -            | μs<br>CLK | -                 |
|       | Display       | th <sub>d</sub> | -            | 50.34<br>320   | -            | μs<br>CLK | -                 |
|       | Pulse-width   | th <sub>p</sub> | 4.0          | 4.7            | -            | μs        | -                 |
|       | Back-porch    | th <sub>b</sub> | -            | 4.7            | -            | μs        | -                 |

Display start period should be pedestal level for analog RGB.

## (2) 240 line mode

|       | Parameter     | Symbol          | Min.         | Typ            | Max          | Unit      | Remark            |
|-------|---------------|-----------------|--------------|----------------|--------------|-----------|-------------------|
| CLK   | Frequency     | 1 / tc          | -            | 157.32         | -            | ns        | 6.3565 MHz        |
| Vsync | Frequency     | tv              | 15.83<br>249 | 16.68<br>262.5 | 17.48<br>275 | ms<br>H   | 59.94 kHz (typ.)  |
|       | Display start | tv <sub>s</sub> | -            | 1.33<br>21     | -            | ms<br>H   | -                 |
|       | Display       | tv <sub>d</sub> | -            | 15.25<br>240   | -            | ms<br>H   | -                 |
| Hsync | Frequency     | th              | 61.65<br>-   | 63.56<br>404   | 65.47<br>-   | μs<br>CLK | 15.734 kHz (typ.) |
|       | Display start | th <sub>s</sub> | -            | 11.01<br>70    | -            | μs<br>CLK | -                 |
|       | Display       | th <sub>d</sub> | -            | 50.34<br>320   | -            | μs<br>CLK | -                 |
|       | Pulse-width   | th <sub>p</sub> | 4.0          | 4.7            | -            | μs        | -                 |
|       | Back-porch    | th <sub>b</sub> | -            | 4.7            | -            | μs        | -                 |

Display start period should be pedestal level for analog RGB.

**NEC****NL3224AC35-06****6.8 INPUT SIGNAL TIMMING WAVE (Composite signal)****(1) Vertical direction****(2) Horizontal direction**



NL3224AC35-06

NEC

## 7. GENERAL CAUTION

**WARNING**

Do not remove the rear case while the LCD module is operating, because dangerous high voltage is generating.

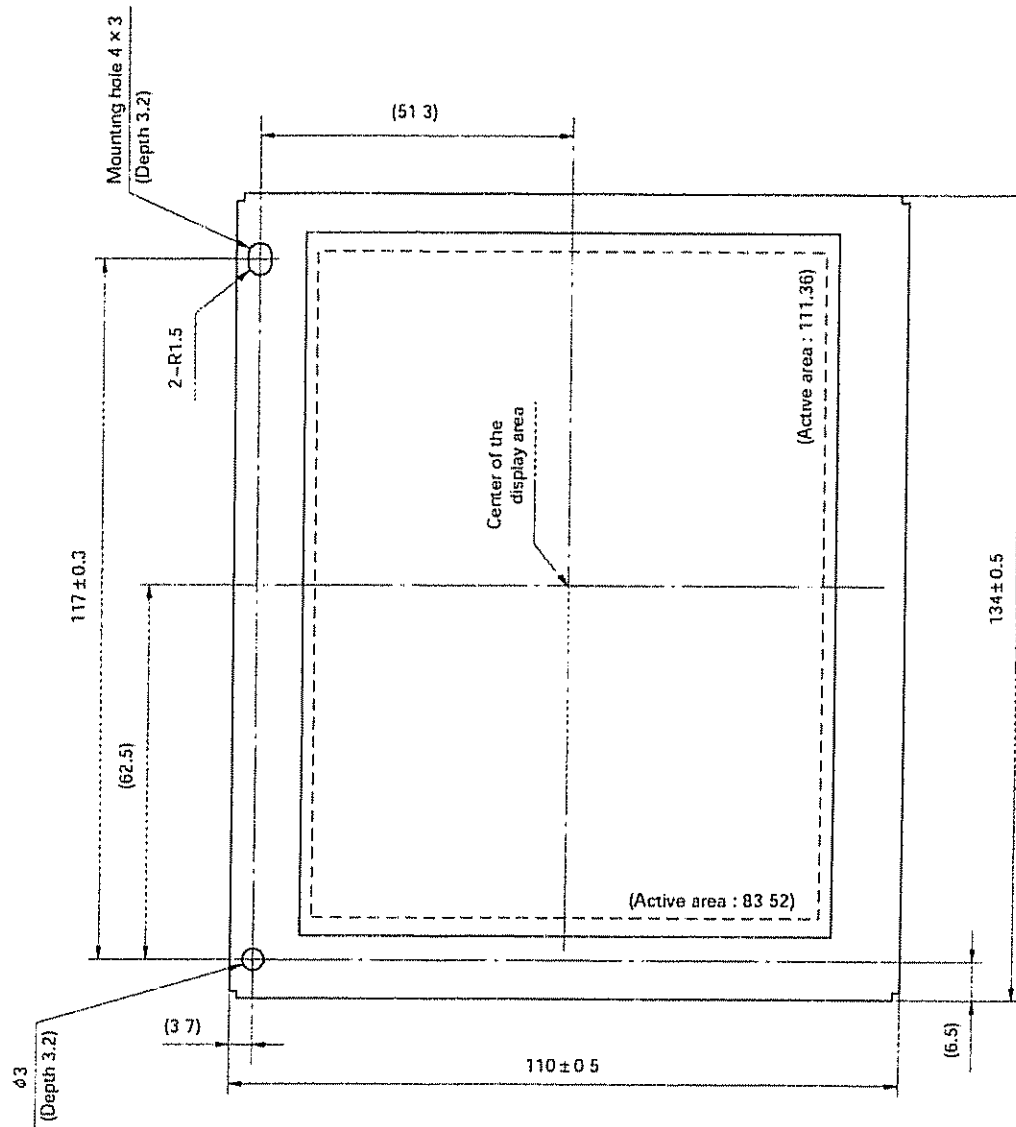
- (1) Caution when taking out the module
  - ① Pick the pouch only, when taking out module from a shipping package.
- (2) Cautions for handling the module
  - ① As the electrostatic discharges may break the LCD module, handle the LCD module with care. Peel a protection sheet off from the LCD panel surface as slowly as possible.
  - ② As the LCD panel and back-light element are made from fragile glass material, impulse and pressure to the LCD module should be avoided.
  - ③ As the surface of polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.
  - ④ Do not pull the interface connectors in or out while the LCD module is operating.
  - ⑤ Put the module display side down on a flat horizontal plane.
  - ⑥ Handle connectors and cables with care.
  - ⑦ The torque to mounting screw should never exceed 0.294 N·m (3.0 kg·cm).
- (3) Cautions for the operation
  - ① When the module is operating, do not lose CLK, HS, or VS signals. If any one of these signals is lost, the LCD panel would be damaged.
  - ② Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
  - ③ Should not intermittently operate the module. It will be the cause of a short life.
- (4) Cautions for the atmosphere
  - ① Dew drop atmosphere should be avoided.
  - ② Do not store and/or operate the LCD module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.
  - ③ Backlight lamp tend to increase the turn on voltage in a cold atmosphere. And the life of module will become short.
- (5) Cautions for the module characteristics
  - ① Do not apply fixed pattern data signal to the LCD module at product aging. Applying fixed pattern for a long time may cause image sticking.
- (6) Other cautions
  - ① Do not disassemble and/or re-assemble LCD module.
  - ② Do not re-adjust variable resistor or switch etc.
  - ③ When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.
  - ④ The information in this document is subject to change without notice. Contact your nearest NEC representative for the latest specifications before designing this device into your system.

Liquid Crystal Display has the following specific characteristics. There are not defects or malfunctions. The display condition of LCD module may be affected by the ambient temperature. The LCD module uses cold cathode tubes for backlighting. Optical characteristics, like luminance or uniformity, will change during time. Uneven brightness and/or small spots may be noticed depending on different display patterns.

NEC

NL3224AC35-06

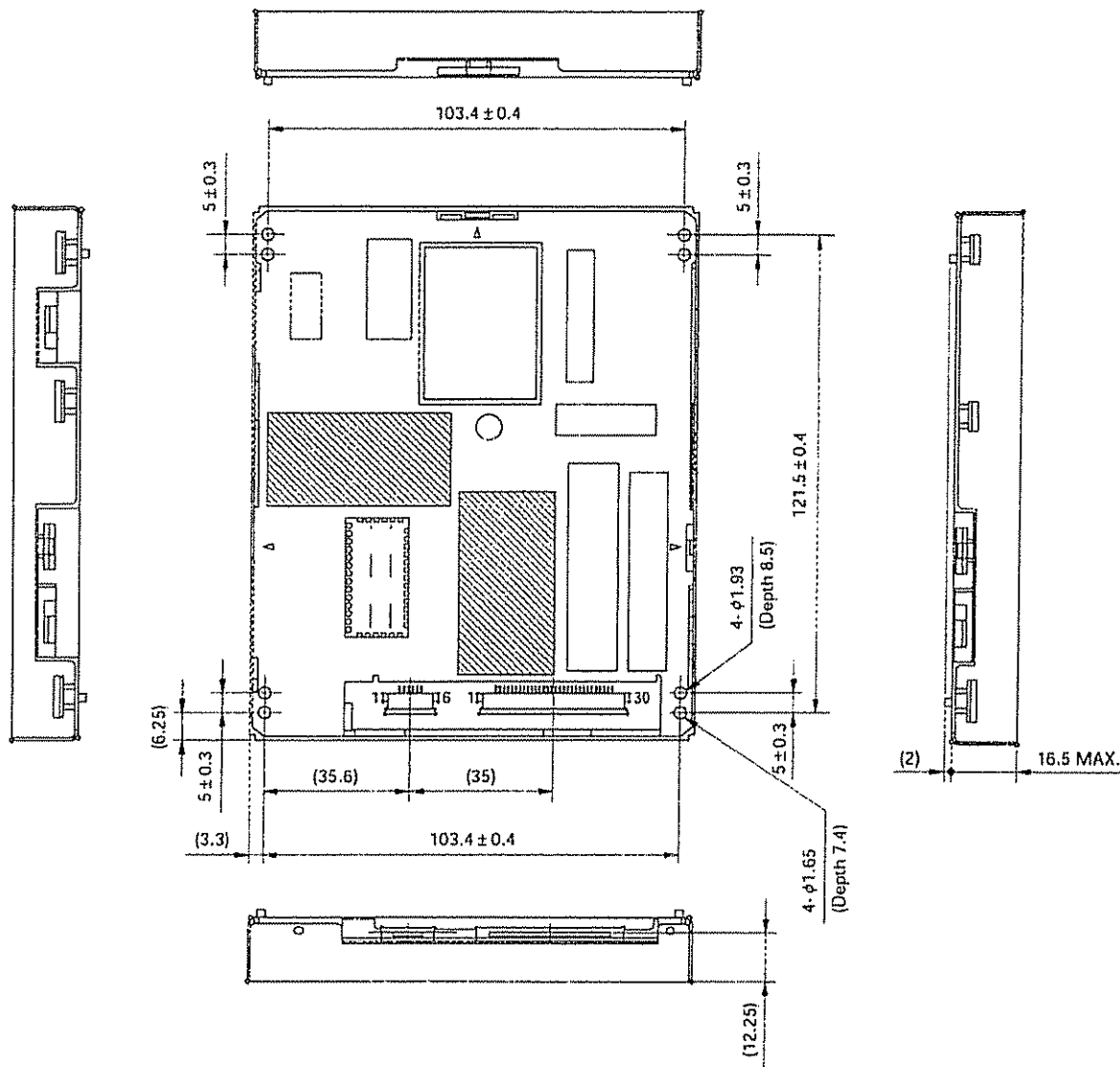
OUTLINE DRAWING (Unit in mm) Front view



NL3224AC35-06

NEC

OUTLINE DRAWING (Unit in mm) Rear view



**NEC**

NL3224AC35-06

---

NL3224AC35-06

**NEC**

---

No part of this document may be copied in any form or by any means without the prior written consent of NEC Corporation.

NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.

---

This datasheet has been download from:

[www.datasheetcatalog.com](http://www.datasheetcatalog.com)

Datasheets for electronics components.

**PROOF OF SERVICE**

**STATE OF CALIFORNIA, COUNTY OF LOS ANGELES**

I am employed in the aforesaid county, State of California; I am over the age of 18 years and not a party to the within action; my business address is **2450 Colorado Avenue, Suite 400E, Santa Monica, CA 90404.**

On February 22, 2007, I served the **NOTICE OF DEPOSITION OF NEC ELECTRONICS AMERICA, INC. PURSUANT TO RULE 30(b)(6)** on the interested parties in this action by placing the true copy thereof, enclosed in a sealed envelope, postage prepaid, addressed as follows:

**SEE ATTACHED SERVICE LIST**

☒ **(BY E-MAIL - -PURSUANT TO THE AGREEMENT OF THE PARTIES)**

☒ **(BY MAIL)**


☐ I deposited such envelope in the mail at Santa Monica, California. The envelope was mailed with postage thereon fully prepaid.

☒ I am readily familiar with the business practice of my place of employment in respect to the collection and processing of correspondence, pleadings and notices for mailing with United States Postal Service. The foregoing sealed envelope was placed for collection and mailing this date consistent with the ordinary business practice of my place of employment, so that it will be picked up this date with postage thereon fully prepaid at Santa Monica, California, in the ordinary course of such business.

☐ **(STATE)** I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

☒ **(FEDERAL)** I declare under penalty of perjury that the foregoing is true and correct, and that I am employed at the office of a member of the bar of this Court at whose direction the service was made.

Executed on February 22, 2007, at Santa Monica, California.

  
Signature

Monica A. Solorzano  
Print Name

SERVICE LIST

Cass W. Christenson, Esq.  
McKenna Long & Aldridge LLP  
1900 K Street, N.W.  
Washington, DC 20006

Jeffrey B. Bove, Esq.  
Jaclyn M. Mason, Esq.  
Connolly Bove Lodge & Hutz LLP  
1008 North Orange Street  
P.O. Box 2207  
Wilmington, DE 19899-2207

Tracy Roman, Esq.  
Raskin Peter Rubin & Simon LLP  
1801 Century Park East, Suite 2300  
Los Angeles, CA 90067

Scott R. Miller, Esq.  
Connolly Bove Lodge & Hutz LLP  
355 S. Grand Ave., Suite 3150  
Los Angeles, CA 90071

Richard D. Kirk, Esq.  
Ashley B. Stitzer  
The Bayard Firm  
222 Delaware Avenue, Suite 900  
P.O. Box 25130  
Wilmington, DE 19899-5130

Frederick L. Cottrell, III, Esq.  
Anne Shea Gaza, Esq.  
Richards, Layton & Finger  
One Rodney Square  
P.O. Box 551  
Wilmington, DE 19899